

Appendix AA

Time of Daily Peak Ozone in the Houston Area

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Purpose

This report considers when peak 1-hour ozone occurs in Houston for three different ozone level categories: ozone below 125 ppb, ozone between 125 and 150 ppb and ozone greater than 150 ppb. In this paper, ozone-days are days with ozone concentration at least 125 ppb and non-ozone days are days with ozone less than 125 ppb.

Analysis

This analysis examined peak daily 1-hour ozone values (i.e. when did the daily peak ozone occur) from 1998 through 2002. Peak ozone values came from 16 sites throughout the Houston area. The hourly peak ozone times were averaged for 5 years for each site and contoured using Kriging, for three ozone levels. The ozone levels are the following: ozone below 125 ppb, ozone between 125 and 150 ppb and ozone greater than 150. The purpose of these levels is to detect time shifts or differences, associated with different ozone levels. Kriging the times of peak ozone was done to interpolate peak ozone times where there are no monitoring sites. Generally there is always some risk in interpolating, such as some important features may be hidden due to the spatial arrangement of the monitoring system, as may be in this case. All time-results will be reported in local standard time.

Results

Differences when the daily peak ozone occurs depends on what levels of ozone we are considering. When peak ozone is less than 125 ppb, ozone peaks between 11:30 and 13:00. When ozone is greater than 125 ppb ozone peak times shift from 13:00 to 14:30 (**Figures 1-3**). This time shift may be due to the concentrations of ozone being higher on ozone days, which can take longer to react away, which in turn can cause the peak daily ozone to occur later. The median reactivity of the sum of all observed pollutants by day was also found to be higher on ozone days (a comparison of medians - **Figure 4**). This suggests that more reactive pollutants may be present on high-ozone days and may affect the rate of ozone formation, which in turn affects the time of peak ozone. **Figure 5** suggests that more pollutants are also present, which can also affect the time peak occurs. Furthermore, higher wind speeds, which tend to occur during lower ozone-days, can dilute ozone concentrations, which may cause the peak ozone to occur sooner.

Peak ozone (on average) occurs earlier near the southeast center of the city (Manchester and Deer Park sites) and later away from the center of the city (NW Harris site), for ozone and non-ozone days (**Figures 1-3**). A reason why the spatial distributions differ may be due to the proximity to the emitters in the immediate area. Also, non-ozone days tend to have winds that ventilate the region, while ozone day can have longer periods of stagnation. Houston tends to experience a period of stagnation when the land breeze is overcome by the sea breeze.

Summary

Daily maximum ozone occurs earlier for non-ozone days than for ozone days and may be due to daily total emission concentrations (amount) reactivity of emissions. The location where the earliest daily peak ozone occurs differs by the proximity to the city core. The closer to the southeast of the city core the earlier the daily peak ozone occurs. Times for ozone levels between 125 and 150 were not much different. A year by year analysis was also done and concluded that the differences from year to year were probably due to random variation, but were similar enough to be consistent with the conclusions presented here.

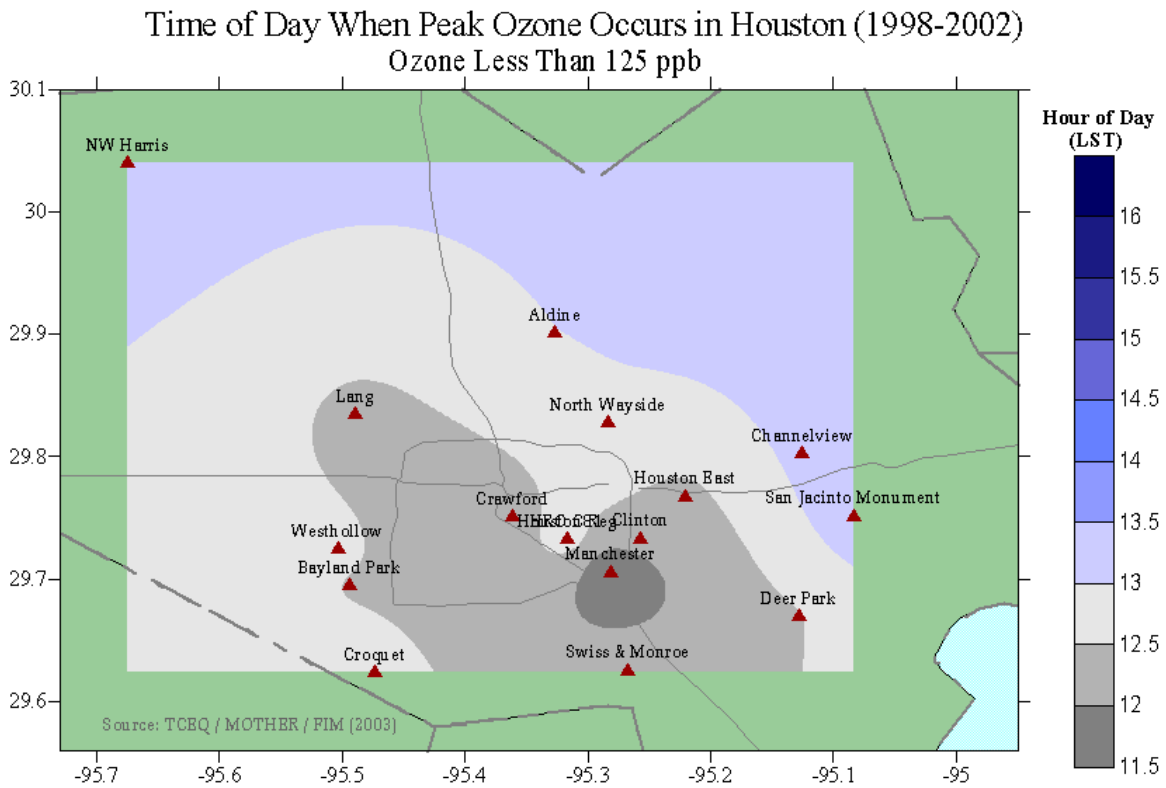


Figure 1

Time of Day When Peak Ozone Occurs in Houston (1998-2002) Ozone Between 125 and 150 ppb

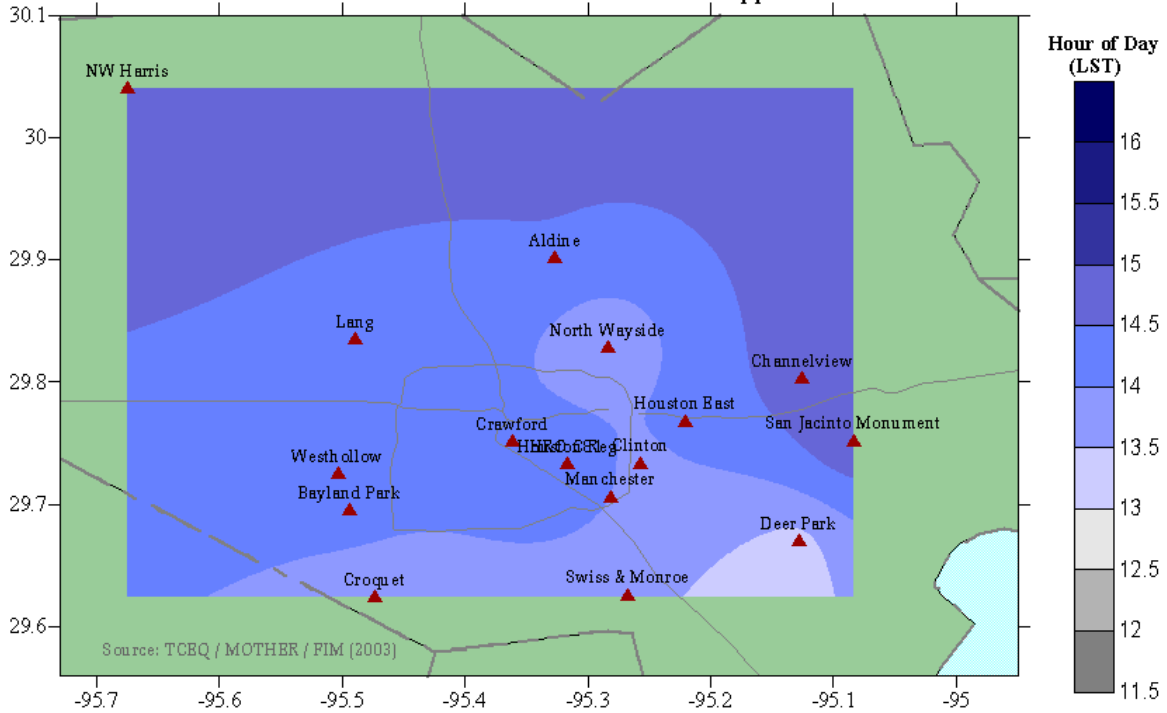


Figure 2

Time of Day When Peak Ozone Occurs in Houston (1998-2002) Ozone Greater of Equal to 150 ppb

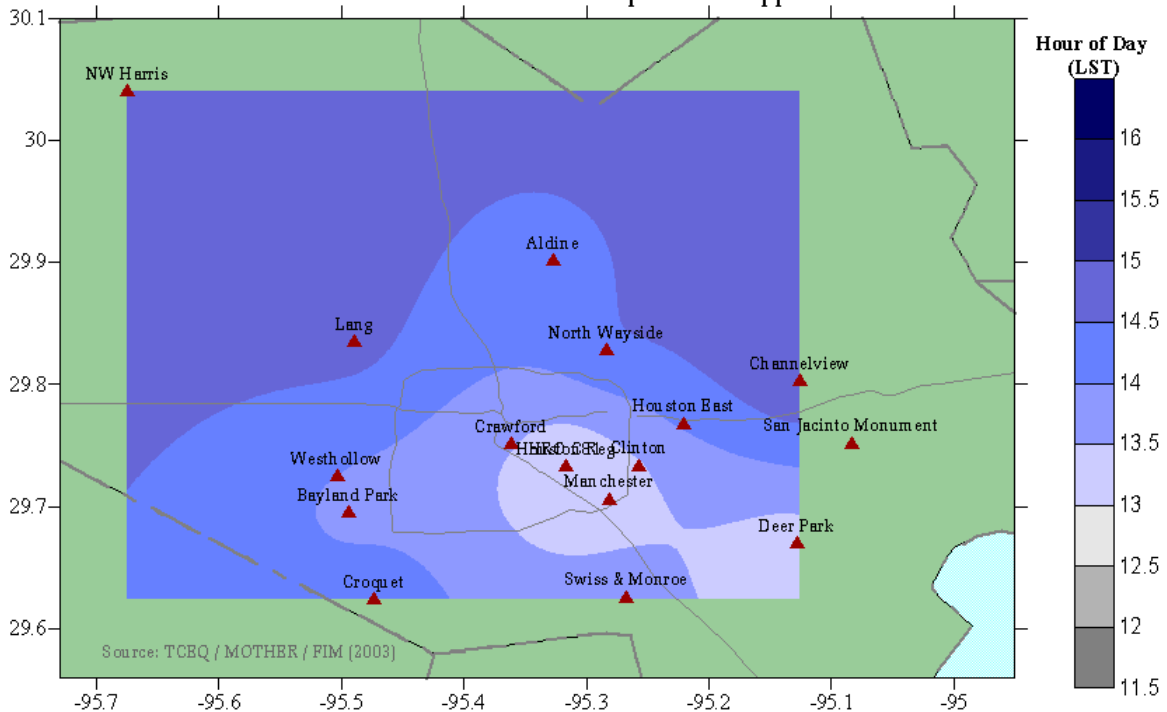
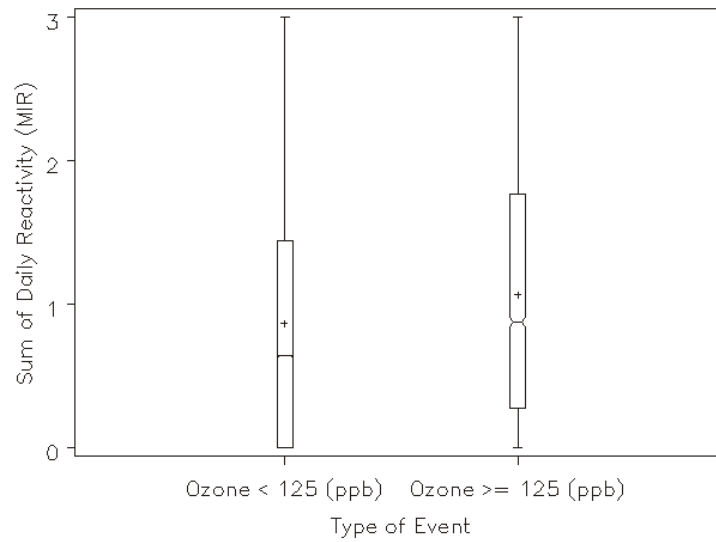


Figure 3

Comparison of High and Low Ozone Events in Houston
1998–2000

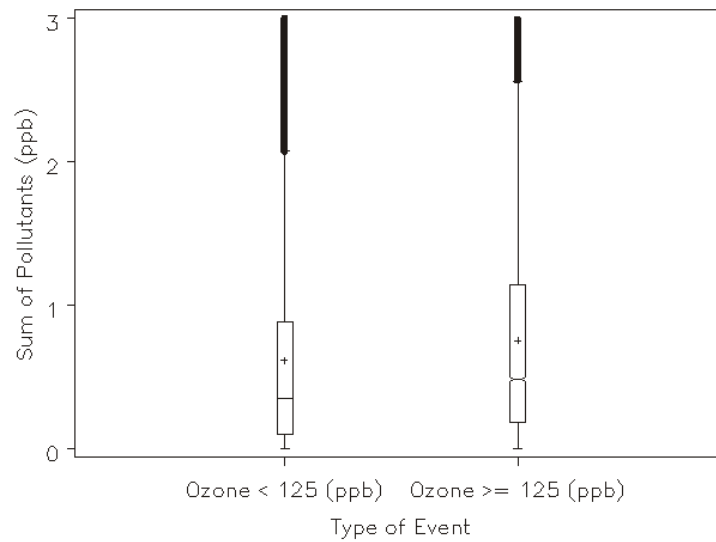


Source: TCEQ/FIM

Note: Data filtered at 3 (MIR) for clarity. Notches denote alpha=.05

Figure 4

Comparison of High and Low Ozone Events in Houston
1998–2000



Source: TCEQ/FIM

Note: Data filtered at 3 (ppbc) for clarity. Notches denote alpha=.05

Figure 5